COPING WITH A POWER FAILURE

UNREALISTIC PRACTICE AUTOROTATIONS

Scenario: A beautiful day in Southern California. A steady, 20-knot wind. An ideal dirt practice landing area just off the airport. A high-time instructor pilot with more than 5,000 successfully completed touchdown autorotations is showing a student how to do it in a MD500D.

At an altitude of 500 feet, he rolls the throttle to ground idle, and for the first time in his experience, the engine actually flames out. The end result is a badly damaged helicopter (fortunately, no injuries). What's wrong with this picture?

Best kept secret

Pete Gillies, Chief Pilot for Western Operations in Rialto, California, shared this exciting experience at a Helicopter Safety Seminar. The title of his presentation was: "The Best Kept Secret in Helicopters."

The secret is that just because you have selected ground idle on the engine control, doesn't mean that the engine won't deliver power to the rotor. If the turbine and rotor tachometer needles (N2 and Nr) are split, then because of the free-wheeling unit, no power is being transmitted to the rotor system.

If, however, the pilot attempts to extend the glide by using such a low rotor speed that the two needles are joined, some power will be transmitted. This also applies when the pilot makes his final collective flare and the rotor speed drops down to the turbine speed.

How much power?

In its ground idle setting, the engine is still burning fuel to keep the compressor turning and its hot exhaust gasses are impinging on the power turbine. For a small turbine such as the Allison 250-C20B, the resulting residual turbine output is about 17 horsepower for the extending-the-glide condition and about 35 for the final pitch-pull. For larger engines, this power is even higher--up to 300 horsepower for the Lycoming T-55 used on the Boeing Chinook.

The net result of all this is that during practice autorotations with low rotor speeds the rotor system appears to have less drag than it really has, and more inertia during the final flare. When the pilot is exposed to a real power-out situation for the first time, the apparent loss in rotor performance can cause dramatic consequences, as this accident demonstrates. Several pilot-survivors of actual engine-out situations have reported: " I pulled pitch but nothing happened!"

Shedding weight

For helicopters with relatively low disc loadings such as the MD500D, each horsepower delivered to the rotor can generate about ten pounds of lift. Thus, for normal practice autorotations, the helicopter thinks it is 200 to 300 pounds lighter than it really is.

This had been Pete's experience during all his previous practice autorotations; when the engine actually failed, he was not prepared for the higher rate of descent and the more sluggish flare characteristics associated with the true weight.

He now suggests that practice autorotations to the ground should be done with the engine actually shut down, or with an artificial limit on how much collective pitch is available to the pilot for his final flare. My suggestion is to install extra ballast to simulate the conditions for a true engine failure.

Recognizing the situation

A note in the MD500D/E flight manuals partially recognizes the situation: "Glide

distances attained during an actual engine out autorotation may be less than the glide distance achieved during practice autorotations when operating at reduced RPM (N2 /Nr needles joined).”

The extra-power at ground idle only exists for helicopters with free-turbine engines. Piston engines and fixed-turbine engines such as used on the Alouette III, Gazelle and Lama do not contribute power at their idle settings.

Because of this, learning to do autorotations in these helicopters may be a valuable experience for all helicopter pilots.

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